



Adapting to Climate Change: Five Economic Ideas “Long Version”

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- 1. The cost of doing nothing is almost surely not zero
- 2. We must adapt together: every place for itself is not a defensible strategy
- 3a. We must put a price on GHG emissions to change our behavior; and,
3b. A clear price signal is the fastest, surest way to mobilize our efforts for effective action
- 4. For Alaskans, the most difficult adaptation will be to higher energy prices
- 5. Local & regional governments have an under-appreciated and special role to play

1. The cost of doing nothing...

- Lord Stern: 5 – 20 % of global GDP
= \$3-12 trillion per year, and rising
- Goodstein, Euskirchen, Huntington:
\$61 - \$371 billion this year, and rising
(loss of Arctic cooling system)
- Pete Larsen: \$4 – 6 – 12 billion
(extra cost of public infrastructure through 2050)
- Ocean acidification: \$???



is not zero

Kivalina



Photo: Northwest Arctic
Borough



Newtok

Example of Rapid Coastal Erosion Impacting the Built Environment

June 2006



It's all uncertain; and uncertainty is harder to manage than "risk"

- Risk is when you know the odds:
 - It will rain about 1 day in 10 in Anchorage, or about 1 day in 2 in Juneau
 - Assessing risk based on reams of data is what actuaries and engineers and planners do
- Uncertainty is when we do not know the odds
 - we don't know the range of outcomes
 - we don't know the probabilities of the outcomes

A long chain of uncertainty

- “To summarize and extend, the economics of climate change consists of a very long chain of tenuous inferences fraught with big uncertainties in every link:
 - Unknown baseline GHG emissions with no policy change
 - Actual emissions after response to policy
 - How do emissions accumulate into stocks of GHG-equivalents
 - How do stocks translate to global mean temperature changes
 - How do global mean temp changes translate to regional climate changes
 - How to regional climate changes translate to human welfare, via adaptation and effects mitigation
 - How are annual effects on human well-being discounted or otherwise aggregated over time to yield a single number for damages”

Economists just don't know!

■ Robert Pindyck:

There are uncertainties in other aspects of climate change policy — for example, how rapidly greenhouse gases (GHGs) will accumulate in the atmosphere absent an abatement policy, to what extent and how rapidly temperature will increase, and the current and future costs of abatement — **but damages from climate change is the area we understand the least.**

Pindyck, R. 2010. Modeling the impact of warming in climate change economics. NBER Working Paper 15692. February 2010

Hence,
Both mitigation and adaptation may
best be viewed as insurance
policies

- Insurance protects individuals from catastrophic losses
- Insurance has a negative rate of return to the buyer, on average
 - It can't be directly compared to a conventional investment with a positive expected return

2. We are all in this together

GHGs are the
“mother of all
externalities”

-- Stern Review

CO₂ travels the globe

CO₂ lasts forever (sort of)

Today's and tomorrow's
warming is the legacy of rich
country baby-boomers

Hansen: 0.85 W/m² unpaid
balance



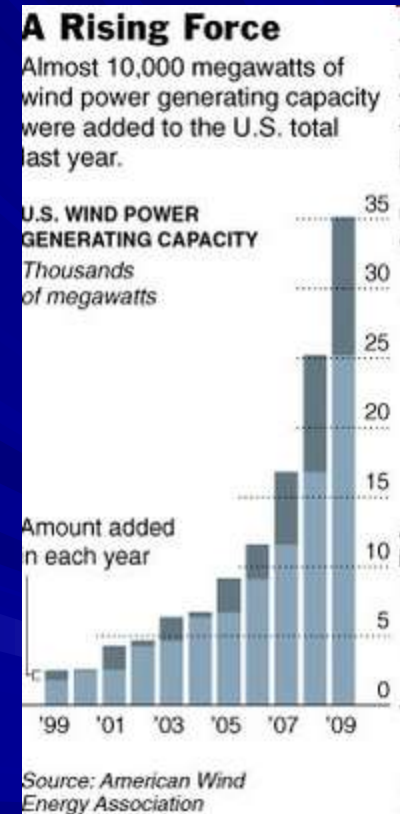
3a. Any honest attempt to mitigate and/or adapt to climate change requires some kind of price on carbon

- Tax: Government sets a price
- Cap & Trade: Market sets a price
- Regulation: Bureaucrats set many different prices
- Command: Dictators set many prices and quantities, too

3b. Overall, an explicit price on carbon helps more than it hurts

- Can be returned to consumers as a cash dividend
- Breaks the logjam of investor uncertainty for clean energy
 - U.S. Wind capacity up 39% in 2009....but
 - China **doubled** its capacity **every year** from 2004-2008
- Guides decisions with less fretting and fussing
- Stimulates innovation – the real engine of economic growth

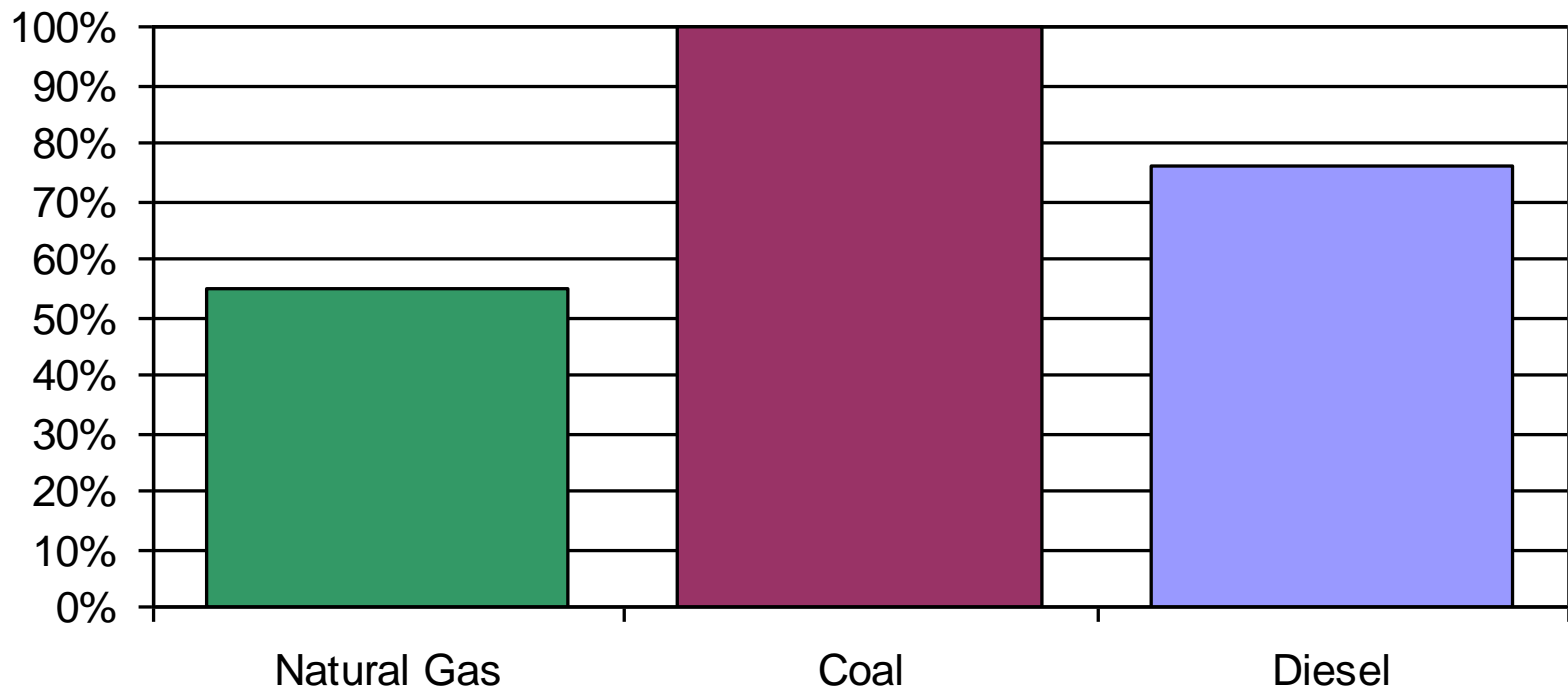
[SO2 example]



Not all fuels are created equal

natural gas CO₂ = 55% of coal

metric tons CO₂-e per unit of energy
relative to coal



When carbon is priced...

- Alaska North Slope gas looks really good!
- Under one scenario *(American Council on Capital Formation / National Association of Manufacturers analysis of Lieberman-Warner)*, 1 ton CO₂
 - wellhead value of AK N Slope gas increases by \$4-9 billion per year
 - State of AK revenues increase by \$1 - 2.2 billion per year

Not all GHGs are equally potent

- CO_2 : GWP = 1 (by definition)
- unburned methane GWP ≈ 25
- nitrous oxide N_2O GWP ≈ 300
1 ton CO_2

IPCC AR4, or

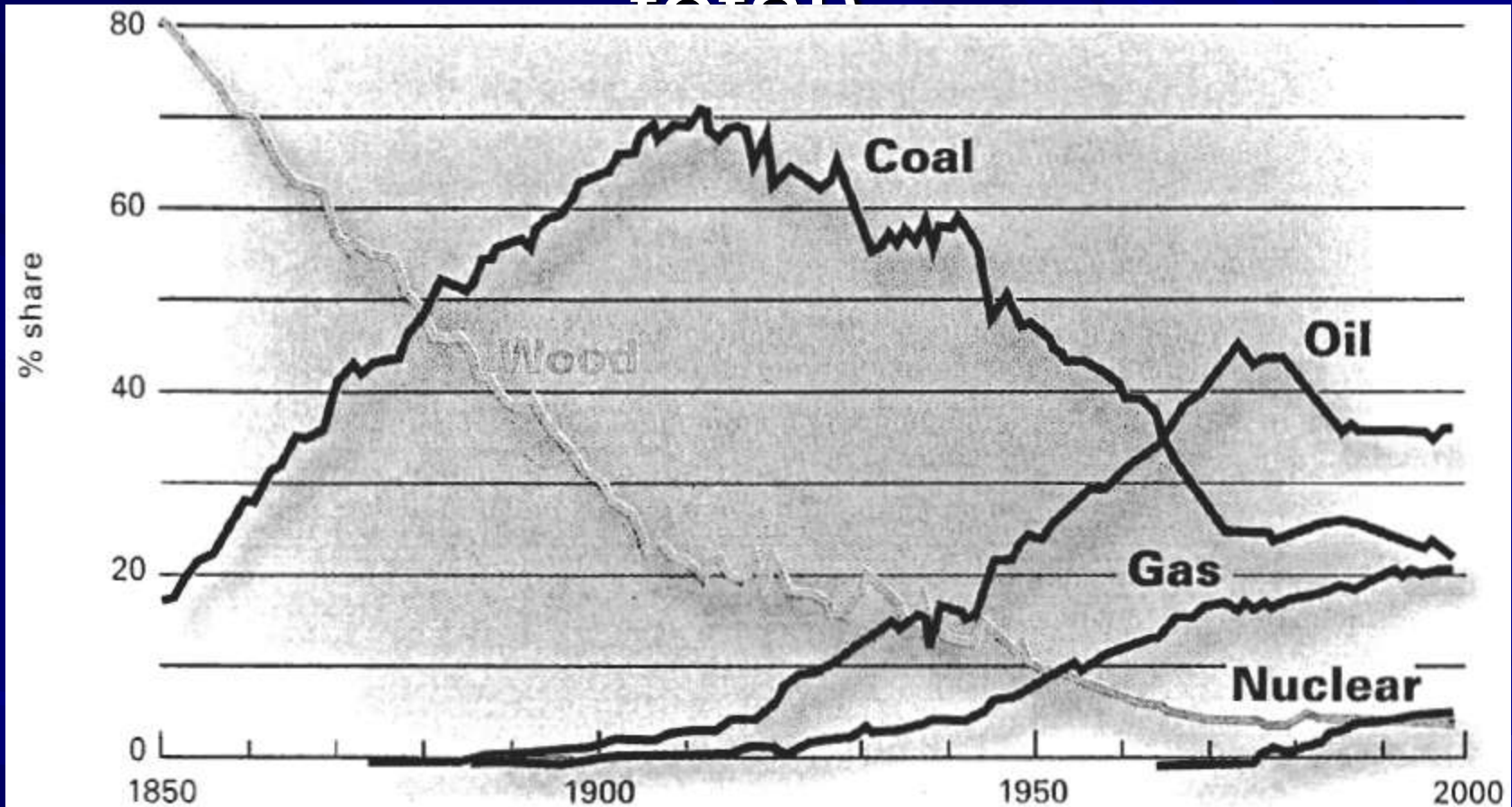
http://www.eia.doe.gov/oiaf/1605/archive/vr03data/summary/special_topic.html

High Price rewards and stimulates invention and



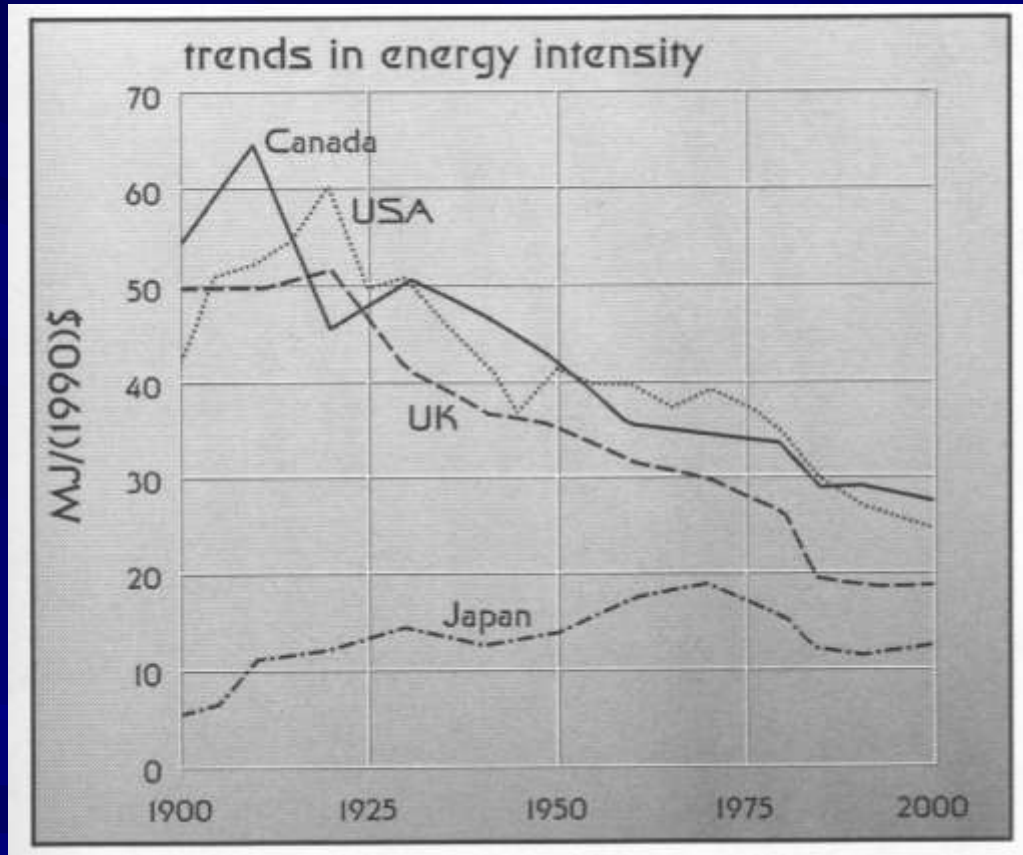
FIGURE 5.1 A typical English coal mine of the steam engine era (the C Pit of the Hebburn Colliery). The engine, housed in the building with a stack, powered the winding and ventilation machinery. *Source:* Reproduced from Hair (1844).

World primary energy sources change over time (shares of total)



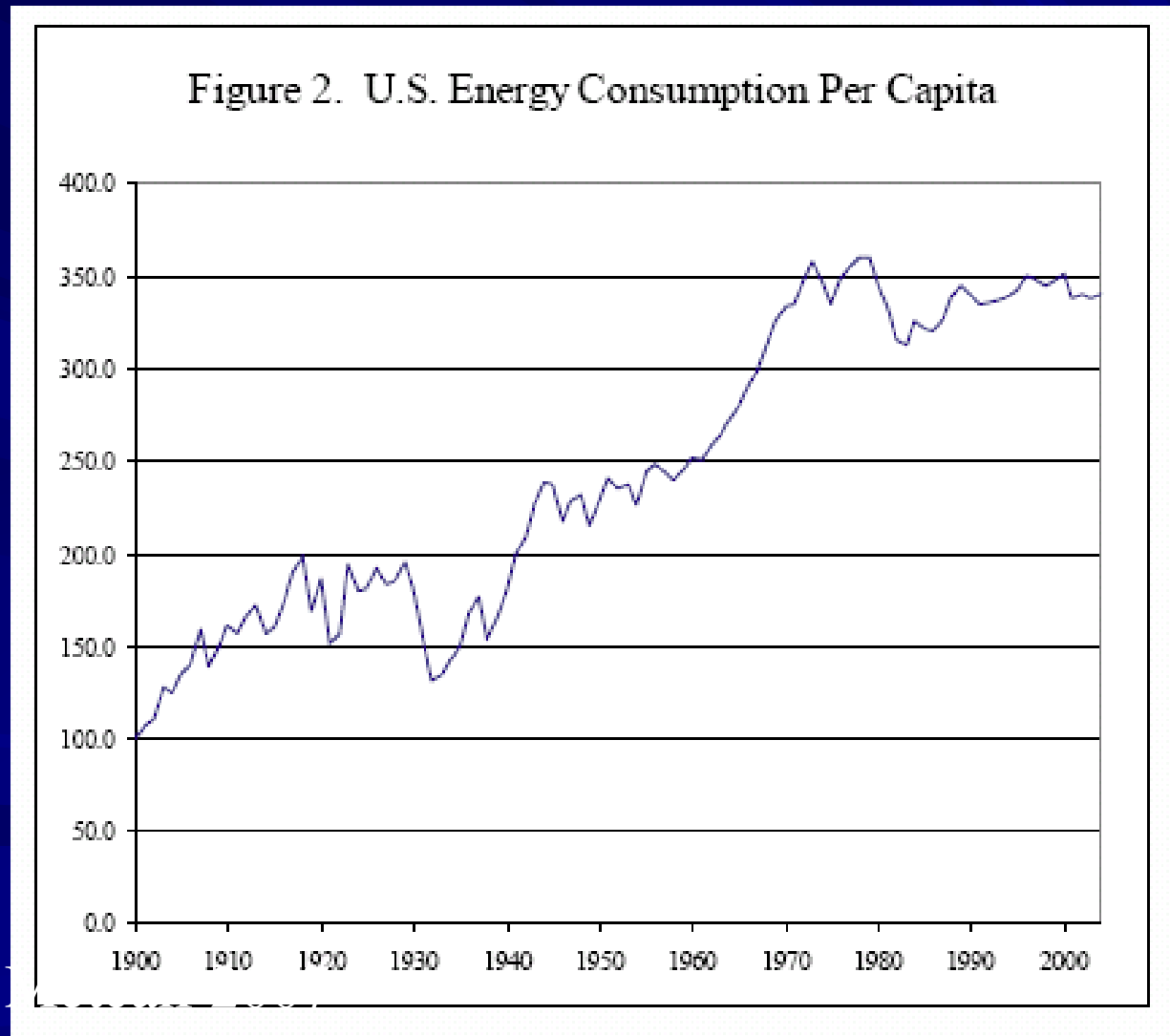
Source: Dr. Nebojsa Nakicenovic, International Institute for Applied Systems Analysis, Laxenburg, Austria.
Private communication, Aug. 20, 2003.

Overall, we seem to be getting more efficient.....



This is how much energy is used per dollar of economic output

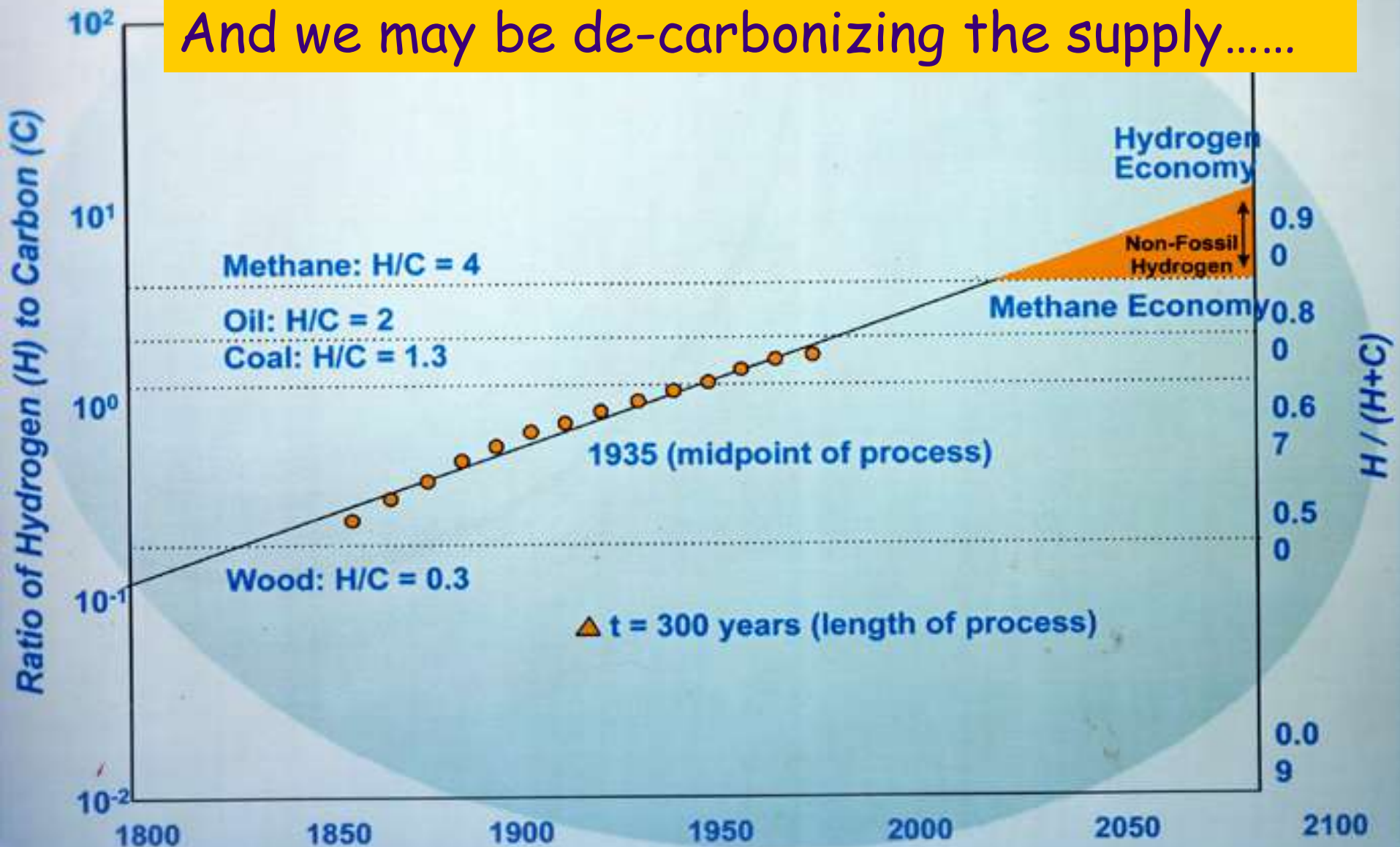
US per capita consumption has stabilized



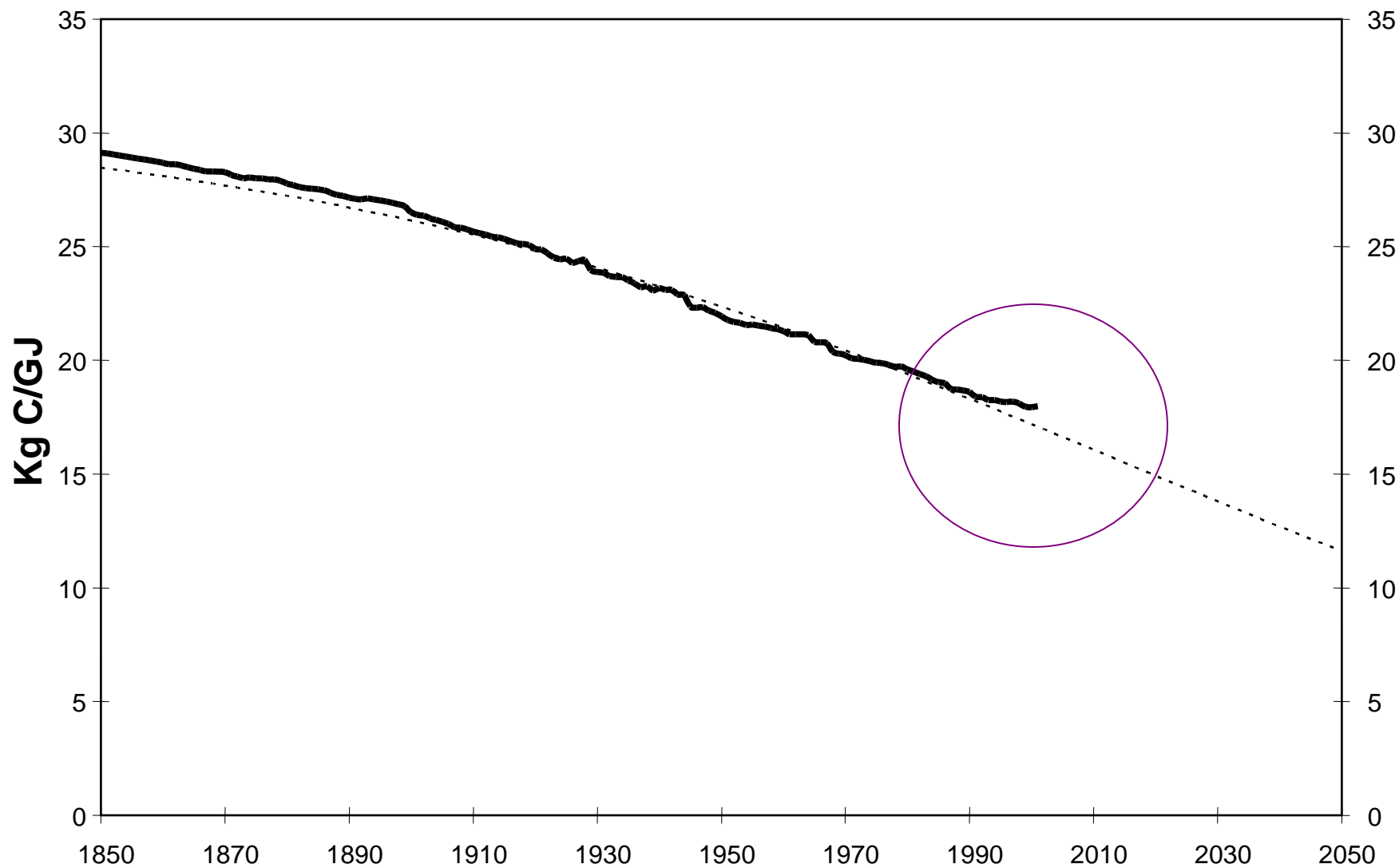


Underlying Decarbonisation

And we may be de-carbonizing the supply.....



Falling Global Carbon Intensity of Primary Energy

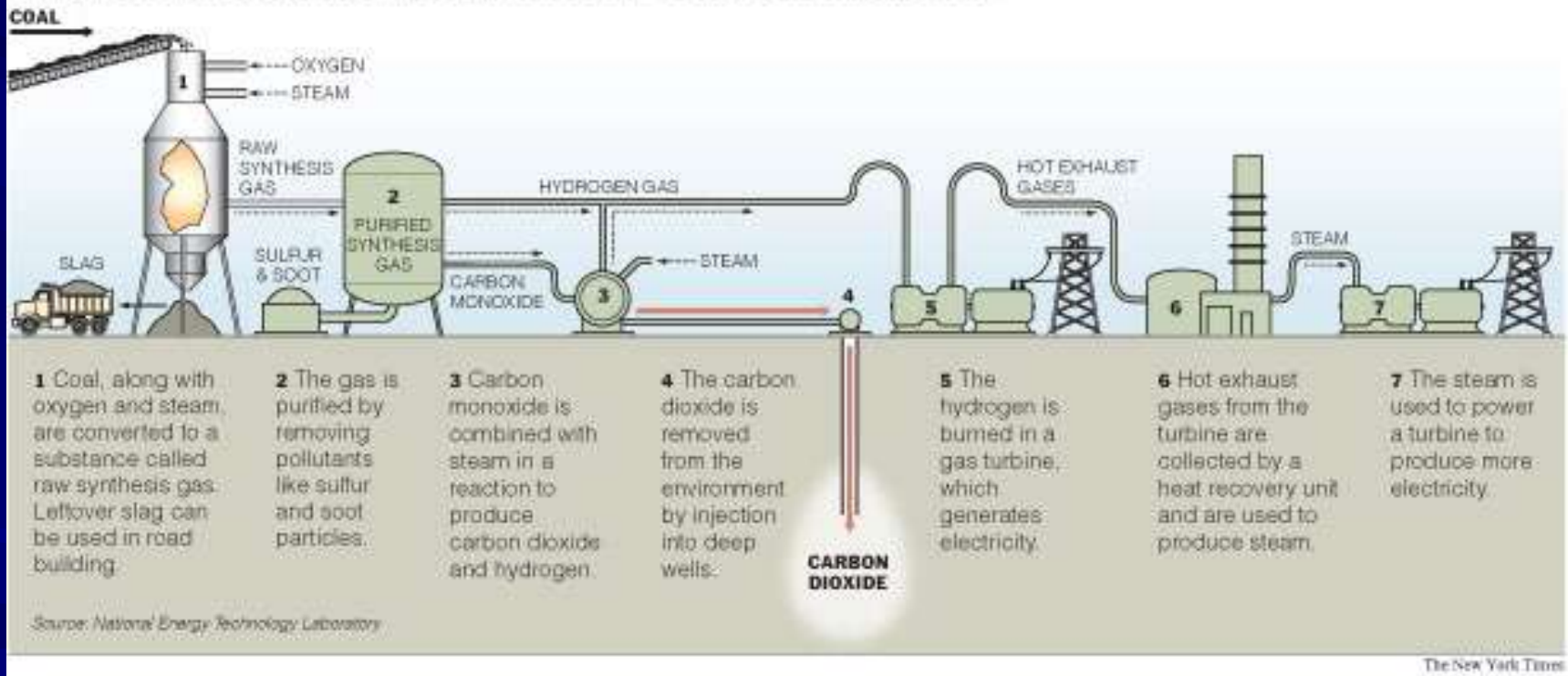


Data sources: IIASA, BP (1965-2001), CDIAC http://cdiac.esd.ornl.gov/trends/emis/em_cont.htm

Carbon capture in a coal power plant

Coal to Gas to Electricity, Minus the CO₂

Coal is a cheap and plentiful source of energy for generating electricity, but the carbon dioxide produced by burning it has contributed to global warming. Turning the coal into fuel gas is one method that makes it easier to dispose of the carbon dioxide.



source: Wald, M. NYT, "Running in Circles over Carbon," 8 June 2008

<http://www.nytimes.com/2008/06/08/weekinreview/08wald.html?ex=1213934400&en=a9908b9bce2df5b7&ei=5070&emc=eta1>

Taxes vs. Cap & Trade

■ Taxes

- Provide cost and investment certainty
- May need to be adjusted if too much or too little change in emissions

■ Cap & Trade

- Provides “certain” level of emissions – sort of
- May need to be adjusted if economy tanks
- Politically easier, can be grandfathered

Wrong Question!

Real question is how are details handled

- Trade effects
- Revenue recycling
- Coverage (all GHGs)
- Flexibility
- Ease of administration
- Offsets?

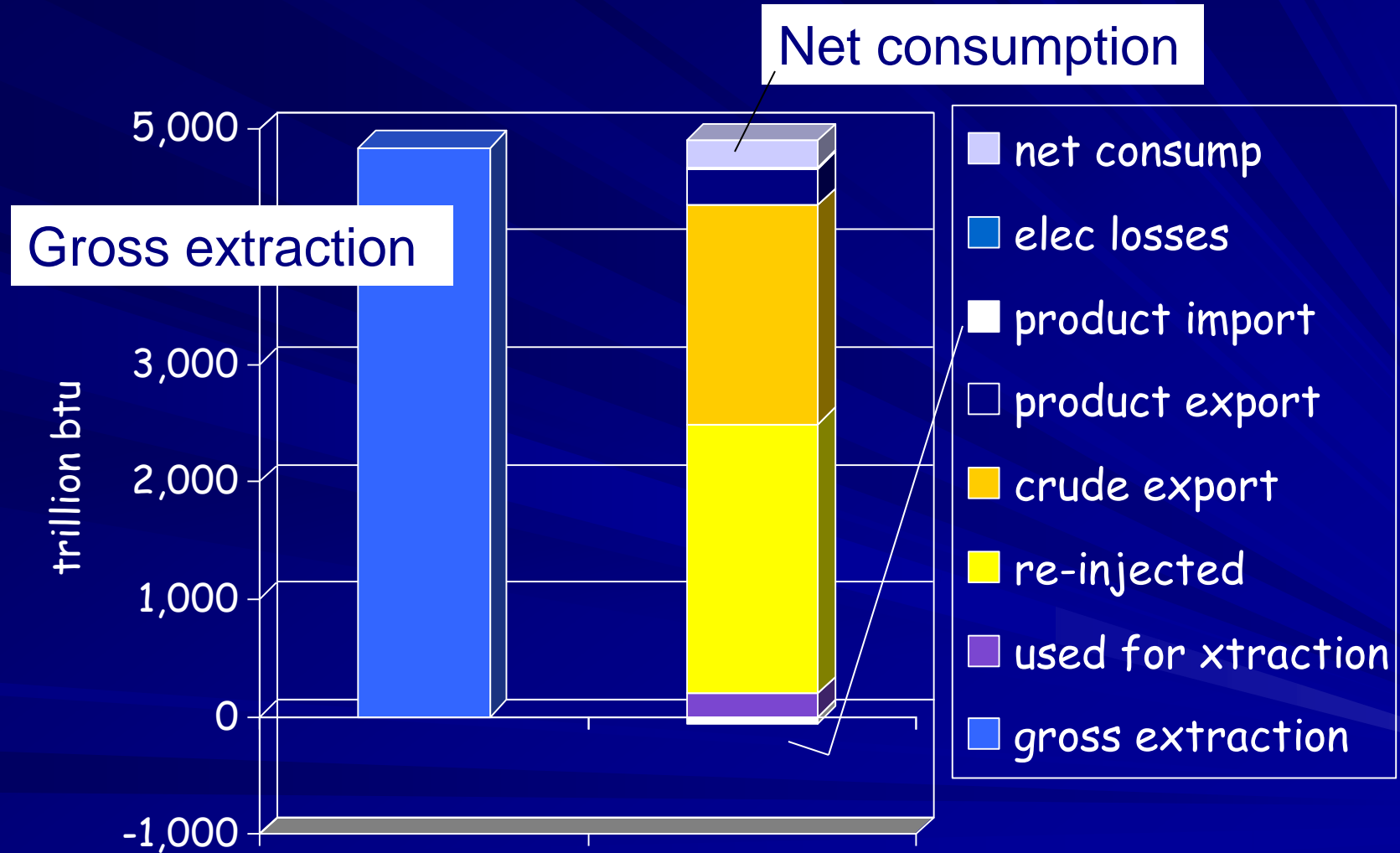
4. For Alaska, a most difficult adaptation is to higher energy prices



Carbon prices do not spell economic apocalypse

- 1 gal gasoline causes about 10 kg of CO₂
- \$100 / ton CO₂ price
 - x [1 ton CO₂ / 100 gal gasoline]
 - = \$1.00 per gallon change in gasoline price
 - also, = 3 cents/kWh for natural gas electricity
 - and, = 8 cents/kWh for diesel electricity
- We've been here before....

Overall disposition of energy in AK



How is Alaska treated in pending bills?

Table 1. Summary of Treatment of Energy Intensive and Trade-Sensitive Industries in Pending Climate Legislation, with Recommended Strategy

	HR 2454	Proposed Senate Bill	Recommended
Commercial fishing operation (example of non-manufacturing industry)			
Eligibility	No specific provision	No specific provision	Use amended definitions of energy and trade intensity. ^a
Free allocations received	None.	None.	None.
Trade protection: imports	No mechanism to deal with non-carbon constrained economies	No mechanism	Employ border tariffs for non-carbon constrained economies
Trade protection: exports	No mechanism to deal with non-carbon constrained economies	No mechanism to deal with non-carbon constrained economies	Rebate percentage of purchased allowances equal to export share of value of shipments

Berman (2010)

How is Alaska treated in pending bills?

Table 1. Summary of Treatment of Energy Intensive and Trade-Sensitive Industries in Pending Climate Legislation, with Recommended Strategy

	HR 2454	Proposed Senate Bill	Recommended
Petroleum refinery			
Eligibility	Domestic fuel producer	Domestic fuel producer	Use amended definitions of energy and trade intensity. ^a
Free allocations received	2 percent of allowances plus an additional 0.25 percent for small business refiners	Same as HR 2454	None.
Trade protection: imports	No mechanism to deal with non-carbon constrained economies	No mechanism	Employ border tariffs for non-carbon constrained economies
Trade protection: exports	Free allowance allocations received reduce costs	Free allowance allocations received reduce costs	Rebate percentage of purchased allowances equal to export share of value of shipments

Berman (2010)

5. Special economic role of municipalities & regional governments

- Local/Regional gov'ts are famous for taking the long view
 - Building codes save **unknown** “statistical” lives at some **unknown** future date
 - water and sewer lines, streets, and schools enable future growth and provide **uncertain future benefits** to society at large
- **It was not always so.....**

[Nantucket]

What local/regional govt can't do

- Cannot price carbon
 - But they can ask for national and international action
- Cannot change individual values and actions
 - But they can make low-carbon choices more viable and more attractive
- Cannot opt out and hide

Take Home

- Now is the perfect time for local & regional govts and citizens and businesses to act
- Adaptation must include responsible participation in the global response to climate change
- A price on carbon is your friend!



Thank You

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